Questions matter

# GCSE
# Physics
## 8463/1H

## Report on the examination

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## General

Grade 4-5 calculation questions ask for students to recall an equation first before using it in a subsequent calculation, however in the 2025 series, students were provided with all of the equations on the Physics Equations Sheet. Subsequently, the performance on all calculations has improved compared with years when equations have needed to be recalled from memory.

The grade 8-9 multistep calculations, question **09.2** and **10.1**, were well attempted with many students scoring full marks. Question **09.2** had nearly three quarters of the students scoring 6 marks, while question **10.1** had almost 60 % of the students scoring 6 marks.

Question **02.2** was well attempted and students who had carried out the specific heat capacity required practical would have had an advantage over those who had not. For this question, just fewer than 40% of the students scored 5 or 6 marks and a further 46% of the students scored 3 or 4 marks.

Handwriting continues to be a problem for a number of students, making it very difficult for examiners to read what has been written. An increasing number of students are using computers to word process their answers for extended response questions, which is helpful for examiners in awarding credit for student responses. However, students must use the question number as printed in the question paper e.g. 04.3 rather than 4(c) to ensure that their work is matched and marked with the corresponding question part.

Many students did not cross out the work they did not want to be marked. This results in the 'list principle' being applied which means if there are two sets of working or answers and they conflict, the student scores zero.

## Levels of demand

Questions are set at three levels of demand for this paper:

- **Standard demand** questions are designed to broadly target grades 4–5.
- **Standard/high demand** questions are designed to broadly target grades 6–7.
- **High demand** questions are designed to broadly target grades 8–9.

A student's final grade, however, is based on their attainment across the qualification as a whole, not just on questions that may have been targeted at the level at which they are working.

## 01.1

Common answers which were insufficient included 'running out', 'not running out', 'sustainable', 'not sustainable'. The specification uses the word 'replenished' so words equivalent to this were needed, so 'replaced' or 'more of the energy resource is produced' were just able to score a mark. For non-renewable the idea that the resource is finite, or there is a limited amount was needed to score the mark. It was not enough to just state the exact

opposite of the renewable energy resources mark point. Just fewer than 20 % of the students scored 2 marks, while just over 50 % of the students scored 1 mark.

## 01.2

Almost all of the students scored this mark for writing down the equation linking density, mass and volume using the equation sheet provided in this exam series.

## 01.3

The vast majority of the students scored 3 marks for this grade 4-5 calculation of mass using the density equation.

## 01.4

This question was poorly answered with fewer than 10 % of the students scoring 2 marks. About 30 % of the students scored 1 mark. Students who said that tidal power output was greater than wind power did not score a mark without reference to a particular flow speed. If wind flow speed was a consistent 2 m/s and tidal flow speed never reached 0.75 m/s the wind turbine's power output would be greater.

## 01.5

A good range of environmental impacts were described by many students. To score within level 2, students needed to make at least one comparative statement about a factor for both turbines. The simplest way of doing this was to compare relative size.
An answer; 'The wind turbine is larger, but harms birds. The tidal turbine harms fish but does not cause visual pollution' would score 4 marks.
Nearly all of the students scored some marks with nearly 50% scoring 3 or 4 marks.

## 02.1

Answers such as 'electrical devices near water' were insufficient, as was 'wires in the water'. A low p.d. power supply also is not a hazard, unless water was spilled on it, in which case it would score for the 'spilled water' which in a typical science laboratory is a hazard by itself. Risks by themselves like electrocution, electric shock or burns did not score but were ignored if given with an appropriate hazard. About 75 % of the students scored this mark usually for identifying 'hot water' or the 'heater' as the hazard. While in this experiment it is unlikely that water is at boiling point, 'boiling water' was creditworthy for 'hot water'.

## 02.2

To score 5 or 6 marks, students needed to be clear how the mass of the water should be determined. There were some very good, straightforward methods seen to calculate specific heat capacity, a graphical approach scored no additional credit. Some students who had more complex methods often became confused with the significance of what the gradient of their graph represented. It was possible for a student to score 6 marks for measuring the energy needed to increase the temperature of a suitable volume of water by just 1°C as the method would work, even if the temperature change is not as large as may be needed to obtain an accurate value.

## 02.3

Almost all of the students scored this mark for identifying that the beaker of water needed insulation and/or a lid. Any named insulation was allowed for this question. Aluminium / tin foil was also allowed as it would reduce energy transfer by infrared radiation. Place the beaker on a 'heatproof' mat was also creditworthy as it would decrease energy transfer through the base of the beaker by conduction.

## 02.4

Nearly three quarters of the students scored 2 marks for this percentage difference calculation. The most common mistake was to calculate the percentage difference between 4200 and 4410 which didn't score marks, unless they had set out the top of the equation correctly, (4410 – 4200) or (4200 – 4410) or calculated the difference of 210. Many students calculated 105 or 1.05, which scored no marks unless the working out was shown.

An answer of 4.76% or working showing a calculation of this figure, rounded to 5% scored no marks.

## 03.1

An answer of; 'Increase the resistance' without a method to do so was insufficient. 'Use the variable resistor' was just enough to score a mark, given there is a variable resistor in the circuit provided. Just over 60 % of the students scored the mark.

## 03.2

Almost all of the students chose the correct equation linking *I*, *V* and *R*.

## 03.3

Just fewer than 90 % of the students scored 4 marks, while a further 7 % of the students scored 3 marks. Reading the value of current from the graph proved difficult for a small minority of the students. A large tolerance was allowed for mark points 2, 3 and 4.

## 03.4

Most students identified that LEDs only allow charge to flow in one direction. Current in one direction was equivalent to this. Some students incorrectly thought that the ammeter was not capable of measuring a negative current, or thought that the order of the components mattered, or that the switch was open. Just over 20 % of the students scored 2 marks, while almost 30 % of the students scored 1 mark.

## 04.1

For marking point 1 a link was needed between the type of gas and the effect it has i.e. the greenhouse effect. Students who incorrectly linked carbon dioxide to ozone depletion could not score the first marking point. Most of the students scored at least 1 mark.

## 04.2

Just fewer than 80 % of the students read the correct value of 8000 kg from the graph. Students who answered incorrectly usually chose the wrong car and wrote 5000 kg or read the maximum value when the electric car had driven 100 000 km.

## 04.3

Just over 90 % of the students scored the mark for correctly reading where the two lines crossed over on the graph. A large tolerance was allowed as the two lines had similar gradients at the cross-over point.

## 04.4

A surprising number of the students thought that carbon dioxide exhaled by the passengers of the car was the cause of the additional carbon dioxide being released. Other incorrect ideas involved the breakdown of the battery or the tyres or the catalytic converter. Few students stated that the car/battery needed (re) charging. Even fewer students linked the electricity generated to a type of energy resource and usually just repeated the information given in the question. Only 15 % of the students scored 2 marks, while a further 35% of the students scored 1 mark.

## 04.5

Just over 70 % of the students chose nuclear and solar as the correct energy resources. The most common incorrect choice was biofuel.

## 05.1

Just over 80 % of the students scored 2 marks for correctly describing what is meant by an isotope of an element. The number of electrons was ignored as this does not define an isotope.

## 05.2

Students needed to say light / lighter / small nuclei to demonstrate they understood that it is only lighter nuclei which fuse. The word fuse could have been substituted for other words like ‘join’, or ‘combine’ but ‘collide’ was insufficient. Some students demonstrated an excellent understanding of the fusion process and fusion in stars was accurately described. Fusion on earth where an extra neutron is released was ignored, as the process as stated in the specification was being tested. Just fewer than 20 % of the students scored 3 marks, while nearly 30 % of the students scored 2 marks and approximately 15 % of the students scored 1 mark.

## 05.3

Most students who scored a mark did so for stating that the reactor walls should not melt. Few students scored the first marking point. Most students were vague and used phrases like the walls need to ‘withstand the high temperatures’ which did not score a mark. Many students confused specific heat capacity with thermal conductivity and thermal insulation. Containing the fusion energy or products was another common insufficient response. Only

about 4 % of the students scored 2 marks, while approximately 40 % of the students scored 1 mark.

## 05.4

Just over 30 % of the students scored the mark for the consequence of an uncontrolled chain reaction. 'Explosion' unqualified was insufficient to score the mark.

## 06.1

Just over 90 % of the students scored 3 marks on this grade 4-5 calculation of temperature increase using the specific heat capacity equation.

## 06.2

Just over 80 % of the students scored 4 marks for this calculation of charge flow using the equation $E = QV$. About 15 % of the students scored 3 marks as they had either not converted or converted incorrectly the energy into Joules.

## 06.3

Students found this question difficult with very few scoring marks because of incorrect assumptions about how potential difference, current and resistance are affected by series and parallel circuits. Marking point 2 was dependent on marking point 1 so that students who stated that the current was increased without a valid reason would not score. The third mark was demanding in requiring an understanding of how $P = IV$ related to the circuit being considered. Just over 80% of the students scored no marks.

## 07.1

Nearly all of the students chose the correct reason for why scientists change the model used to describe the structure of an atom.

## 07.2

Many students were confused about the distinction between irradiation and radioactive contamination. Many thought that it had to do with being exposed to radiation inside or outside the body, or one causing harm the other not causing harm. Exposure to a radioactive source was insufficient to score the irradiation mark. Without using the word 'exposed' students often did not express their ideas clearly enough. 'Absorbing radiation from a source' would have been another way of gaining credit for this idea. Students were more secure explaining what radioactive contamination meant and often gave examples like 'radioactive dust' or radioactive atoms' being present on or in people / objects. Almost a quarter of the students scored 2 marks, while just over 40 % of the students scored 1 mark.

## 07.3

About 90 % of the students scored 2 marks for this nuclear equation, while about 5 % of the students scored 1 mark.

## 07.4

'4 half-lives' needed to be seen to score the first mark, the number '4' was not sufficient by itself for a mark. The most common mistake was to divide 256 000 by 16 000 to give an answer of 16, which scored no marks. Just over 70 % of the students scored 3 marks.

## 07.5

More / less active was insufficient as was a description of activity in terms of rate of decay.
Just over 20 % of the students scored 2 marks, while a further 12 % of the students scored 1 mark.

## 08.1

Just fewer than 90 % of the students scored 4 marks on this calculation of specific latent heat. Students who did not convert or incorrectly converted the mass could score a maximum of 3 marks.

## 08.2

Most students did not refer to the energy of the particles in terms of kinetic and potential energy, so scoring no marks. Many students thought the kinetic energy of the particles changed which limited them to scoring only the first marking point. Only about 3 % of the students scored 2 or 3 marks, while just over 10 % of the students scored 1 mark.

## 08.3

Students made good attempts at answering this challenging question about gas pressure. Technical accuracy was important for the second and third marking points, so it needed to be clear that particle collisions with the container walls were more frequent, more often or at a greater rate of collision. More frequent collisions between particles was insufficient for the second mark. The third marking point needed to reference the forces involved in collisions with the container walls, an implied greater force per collision was acceptable, but not a macroscopic force linked to force and area as that was not being tested. Almost half of the students scored 3 or 4 marks, while almost 40 % of the students scored 1 or 2 marks.

## 09.1

Many of the students did not convert the 70 cm into metres and some students converted the energy unnecessarily. Not converting the height stopped marking point 1 from scoring and converting the energy unnecessarily stopped 1 marking point from being scored too. Some students, despite setting out their calculations correctly, did not use brackets around the denominator and arrived at an answer of 0.0245 or 2.45. Nearly 80 % of the students scored full marks on this question.

## 09.2

Many students found it easy to score full marks on this multi-step calculation. The most common mistake was not to convert the time which resulted in an answer of 27 and scored 5 marks. Converting the time incorrectly e.g. converting time into 0.5 hours also scored 5 marks. About 90% of the students scored either 5 or 6 marks.

## 09.3

Many students understood that the flow rate would increase. This was often correctly linked to either more useful energy transferred or less wasted energy. Some students expressed their ideas in terms of power. Just over 40 % of the students scored 2 marks, while just over 40 % scored 1 mark.

## 10.1

Many students were successful with this multi-step calculation question. Nearly 60% of the students scored 6 marks, while almost 10 % scored 5 marks. A significant number of students tried to answer the question using equations from paper 2, which was creditworthy, but virtually no students arrived at the correct answer using this method. Some students scored the significant figures mark by completing an incorrect calculation using all the data provided in the question. The most common mistake was not squaring the extension in the elastic potential energy equation. Ensuring that students substitute first before rearranging is a good way of scoring method marks in calculations, even if the final answer is incorrect.

## 10.2

Students who stated the names of energy stores didn't score any marks unless they stated how the amount of energy changed or stated that kinetic energy was transferred to gravitational potential energy, for example. Mention of elastic potential energy from the spring in Q10.1 was ignored for this question. $E_k$ and *KE* were acceptable abbreviations for kinetic energy; $E_p$ and *GPE* were acceptable abbreviations for gravitational potential energy. Just over 60 % of the students scored 3 marks, while just over 10% scored 2 marks and just fewer than 10 % scored 1 mark.

## 10.3

Only about 25 % of the students scored 2 marks for identifying the correct measurements needed to determine the speed of the car at the end of the track. Nearly 75% of the students scored 1 mark. The most common incorrect choice was the length of the track.

## Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.